CLAIMS

WE CLAIM:

1. A pharmaceutical composition comprising:
elemental selenium (Se(0)) particles; and
a pharmaceutically acceptable delivering medium.

2. The pharmaceutical composition of claim 1, further comprising:
a carrier molecule that can be internalized by a living cell wherein the carrier molecule forms a conjugate with one or more Se(0) particles.

3. The composition of claim 1, wherein the Se(0) particles have a diameter of 0.4 to 50 nanometers.

4. The composition of claim 1, wherein the Se(0) particles have a diameter of 0.4 to 5 nanometers.

5. The composition of claim 1, wherein the Se(0) particles have a diameter of 0.4 to 1 nanometer.

6. The composition of claim 1, wherein the Se(0) particles can form a Se(0) colloid in a dispersion medium.

7. The composition of claim 2, wherein the carrier molecule is target cell-specific.

8. The composition of claim 2, wherein the carrier molecule is selected from the group consisting of proteins, glycoproteins and lipoproteins.

9. The composition of claim 2, wherein the carrier molecule is selected from the group consisting of albumin, high density lipoprotein, low density lipoprotein and very low density lipoprotein.

10. The composition of claim 2, wherein the carrier molecule is albumin.

11. The composition of claim 2, wherein the living cell is selected from the group consisting of a cancer cell, an immune cell responsible for an autoimmune disorder, an alloreactive lymphocyte responsible for graft-versus-host disease or a rejection reaction, , a parasite and a parasitized blood cell.

12. The composition of claim 2, wherein the living cell is a cancer cell.

13. A method for causing a cell to die comprising the step of:

treating the cell, or a human or nonhuman subject having the cell, with the composition of claim 1 in an amount sufficient to kill the cell.

14. The method of claim 13, wherein the method comprises the step of treating the cell, or a human or nonhuman subject having the cell, with the composition of claim 2 in an amount sufficient to kill the cell.

15. The method of claim 13, wherein the method comprises the step of treating the cell, or a human or nonhuman subject having the cell, with the composition of claim 6 in an amount sufficient to kill the cell.

16. The method of claim 13, wherein the method comprises the step of treating the cell, or a human or nonhuman subject having the cell, with the composition of claim 7 in an amount sufficient to kill the cell.

17. The method of claim 13, wherein the method comprises the step of treating the cell, or a human or nonhuman subject having the cell, with the composition of claim 10 in an amount sufficient to kill the cell.

18. The method of claim 13, wherein the cell is selected from the group consisting of a cancer cell, an immune cell responsible for an autoimmune disorder, an alloreactive lymphocyte responsible for graft-versus-host disease or a rejection reaction, a parasite and a parasitized blood cell, and the method comprises the step of treating the cell, or a human or nonhuman subject having the cell, with the composition of claim 11 in an amount sufficient to kill the cell.

19. The method of claim 13, wherein the cell is a cancer cell and the method comprises the step of treating the cell, or a human or nonhuman subject having the cell, with the composition of claim 12 in an amount sufficient to kill the cell.

20. A method for sensitizing a cell to a cytotoxic agent wherein the cell is resistant to the cytotoxic agent due to the presence of intracellular glutathione, the method comprising the step of:

treating the cell, or a human or nonhuman subject having the cell, with the composition of claim 1.

21. A method for causing a cell to die wherein the cell is resistant to a cytotoxic agent due to the presence of intracellular glutathione, the method comprising the steps of:

treating the cell, or a human or nonhuman subject having the cell, with the composition of claim 1; and

exposing the cell to the cytotoxic agent.

22. The method of claim 21, wherein the cell or a human or nonhuman subject having the cell is treated with the composition of claim 2.

23. The method of claim 21, wherein the cell is a cancer cell.

24. The method of claim 21, wherein the cytotoxic agent is selected from the group consisting of ionizing radiation and alkylating agents.

25. A method of reducing intracellular glutathione level of a cell comprising the step of:

treating the cell, or a human or nonhuman subject having the cell, with the composition of claim 1 in an amount sufficient to reducing intracellular glutathione level of the cell.

26. A method for generating Se(0) comprising the steps of:

providing a photosensitizing selone dye;

exposing the dye to light of a suitable wavelength in the presence of molecular oxygen; and

purifying Se(0).

27. The method of claim 26, wherein the photosensitizing selone dye is selected from the group consisting of a selenomerocyanine dye and a selenooxonol dye.

28. The method of claim 27, wherein the selenomerocyanine dye is selected from the group consisting of MC54, MC55, MC56 and MC57.

29. The method of claim 26, wherein Se(0) is colloidal Se(0).

30. The method of claim 26, wherein the light of suitable wavelength is generated by light-emitting diodes (LED).

31. A method for generating a conjugate of Se(0) and a carrier molecule that can be internalized by a living cell, the method comprising the steps of:

providing a selone dye;

exposing the dye to light of a suitable wavelength in the presence of molecular oxygen to generate Se(0);

mixing the carrier molecule with the dye before, at the same time, or after the dye is exposed to the light to generate the conjugate of Se(0) and the carrier molecule; and

purifying the conjugate of Se(0) and the carrier molecule.

32. The method of claim 31, wherein the photosensitizing selone dye is selected from the group consisting of a selenomerocyanine dye and a selenooxonol dye.

33. The method of claim 32, wherein the selenomerocyanine dye is selected from the group consisting of MC54, MC55, MC56 and MC57.

34. The method of claim 31, wherein Se(0) is colloidal Se(0).

35. The method of claim 31, wherein the light of suitable wavelength is generated by LED.

36. The method of claim 31, wherein the carrier molecule is selected from the group consisting of proteins, glycoproteins and lipoproteins.

37. The method of claim 31, wherein the carrier molecule is selected from the group consisting of albumin, high density lipoprotein, low density lipoprotein and very low density lipoprotein.

38. The method of claim 31, wherein the carrier molecule is albumin.

39. A method for generating a conjugate of a chromophore photoproduct and a carrier molecule wherein the carrier molecule can be internalized by a living cell, the method comprising the steps of:

providing a merocyanine dye that contains a sulfur or a selenium atom in the donor heterocycle;

exposing the dye to light of a suitable wavelength in the presence of molecular oxygen to generate the chromophore photoproduct;

mixing the carrier molecule with the dye before, at the same time, or after the dye is exposed to the light to generate the conjugate of the chromophore photoproduct and the carrier molecule; and

purifying the conjugate of the chromophore photoproduct and the carrier molecule.

40. A pharmaceutical composition comprising:

partially or completely purified fluorescent conjugates generated according to claim 39; and

a pharmaceutically acceptable delivering medium.

41. The pharmaceutical composition of claim 40, further comprising:

Se(0)-carrier conjugates.

42. A method for determining the presence of a target cell wherein the target cell internalizes more carrier molecules than a control cell, the method comprising the step of:

treating the target cell, or a human or nonhuman subject having the target cell, with the composition of claim 40 in an amount sufficient to determine the presence of the target cell.

43. The method of claim 42, wherein the target cell is a cancer cell.

44. A method for monitoring the entering and the amount of Se(0)-carrier conjugates that enters into a target cell, the method comprising the step of:

treating the target cell, or a human or nonhuman subject having the target cell, with the composition of claim 41 wherein the carrier molecules in the fluorescent conjugates and the Se(0)-carrier conjugates are the same.

45. A method for generating Se(0) and a chromophore photoproduct comprising the steps of:

providing a selenomerocyanine dye that contains a sulfur or a selenium atom in the donor heterocycle;

exposing the dye to light of a suitable wavelength in the presence of molecular oxygen to generate Se(0) and the chromophore photoproduct; and

purifying at least one of Se(0) and the chromophore photoproduct.

46. A method for generating a conjugate of Se(0) and a carrier molecule, and a fluorescent conjugate of a chromophore photoproduct and the same carrier molecule, wherein the carrier molecule can be internalized by a living cell, the method comprising the steps of:

providing a selenomerocyanine dye that contains a sulfur or a selenium atom in the donor heterocycle;

exposing the dye to light of a suitable wavelength in the presence of molecular oxygen to generate Se(0) and the chromophore photoproduct;

mixing the carrier molecule with the dye before, at the same time, or after the dye is exposed to the light to generate the conjugate of Se(0) and the carrier molecule, and the fluorescent conjugate of the chromophore photoproduct and the carrier molecule; and

purifying at least one of the conjugate of Se(0) and the carrier molecule and the fluorescent conjugate of the chromophore photoproduct and the carrier molecule.

47. A method for generating a Se(0)-carrier conjugate comprising the step of:

reducing selenium dioxide, selenious acid or selenite salts in the presence of a carrier molecule.